Appl. No. 09/856,342
Amdt. Dated January 24, 2005
Reply to Office Action of October 26, 2004

REMARKS/ARGUMENTS

Claims 7 – 9, 11, 12, and 16 - 19 are pending in this application.

Claim 7 has been amended.

In the Office Action, claims 7, 9, 11, 12, and 19 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 4,790,743 to Leikert et al. Furthermore, in the Office Action, claims 8 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Leikert et al '743 as applied to claims 7 and 9 and further in view of U.S. Patent No. 5,411,394 to Beer et al. Additionally, in the Office Action, claims 7 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Leikert et al '743 in view of U.S. Patent No. 4,739,713 to Vier et al. Also, in the Office Action, claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Leikert et al '743 in view of U.S. Patent No. 4,739,713 to Vier et al as applied to claim 7 and further in view of U.S. Patent No. 5,809,910 to Svendssen et al.

With respect to the rejection of claims 7 – 9, 11, 12, and 16 – 19 under 35 U.S.C. 103(a), the Applicants request favorable reconsideration in view of the amendment of claim 7 and the following comments.

The present invention, as recited in claim 7 as currently amended, relates to a method of burning a nitrogen-containing fuel while reducing the emission of nitrogen oxides. The inventive method includes the steps of producing a sub-stoichiometric primary zone in the form of a flame core from all of the fuel and primary air, and supplying the flame core with a nitrogen oxide reducing agent so that the reducing agent is distributed within the flame core, wherein the reducing agent is a nitrogen compound or a hydrocarbon.

Leikert et al '743 discloses a method for burning a nitrogen-containing fuel,

while reducing the emission of nitrogen oxides. Leikert et al '743's method includes the steps of producing a sub-stoichiometric primary zone 7 in the form of a flame core and also injecting, at a secondary fuel zone 8 outside of the primary flame zone 7, a reduction fuel, the reduction fuel being injected via reduction fuel nozzles 4. Thus, Leikert et al '743 teaches away from the inventive method of supplying the sub-stoichiometric primary zone with a nitrogen oxide reducing agent for the reason that Leikert et al '743 teaches its primary flame zone 7 to which a primary fuel (coal dust) and combustion air are fed, and teaches that a reducing agent is introduced into its secondary flame zone 8, not its primary flame zone 7.

While Leikert et al '743 discloses that this reduction fuel injected into its primary flame zone 7 can be coal dust, Leikert et al '743 does not teach or disclose that coal dust introduced into its primary flame zone 7 is a reducing agent. Instead, any coal dust introduced into the primary flame zone 7 of Leikert et al '743 merely serves as a primary combustion fuel. Leikert et al '743 itself distinguishes between coal dust that is fed into the primary flame zone 7 as a primary fuel and coal dust that is injected into the secondary flame (reduction) zone 8. For example, Column 2, lines 44 – 53, of Leikert et al '743 discloses that the coal dust for reduction purposes may be differently prepared than the coal dust intended for primary fuel purposes. This acknowledgement by Leikert et al '743 that coal dust introduced into its primary fuel zone 7 is for primary fuel purposes (not reduction purposes) and that coal dust injected into its secondary flame zone 8 is for reduction purposes is highlighted, for example, in Column 2, lines 57 – 59: "The carrier gas for the <u>primary coal dust</u> and/or the <u>reduction coal dust</u> is selected from the group: air, flue gas of the combustion or mixtures thereof." In fact, increasing the amount of coal dust

introduced into the primary flame zone 7 of Leikert et al '743 would merely change the air to fuel ratio (stated, in Column 3, line 61 of Leikert et al '743 as n = 0.9); in accordance with Leikert et al '743's arrangement, reduction would still be effected in the secondary flame zone 8.

The inventive NO_x reducing method does not call for the NO_x reduction to be accomplished in a secondary zone and is thus neither anticipated by, nor obvious in view of, the conventional arrangements such as disclosed in Leikert et al '743 wherein the NO_x is produced in the primary flame zone before the thus-produced NO_x is then reduced in the secondary flame zone. In contrast, in the present invention as recited in claim 7 as currently amended, the NO_x reducing agent is introduced directly into the primary zone - that is, the flame core at which the combustion fuel and the primary air are fed – so that the NO_x reducing agent is distributed in the flame core. In the event that the respective NO_x reducing agent introduced in accordance with the method of the present invention is a hydrocarbon, this hydrocarbon is not a nitrogen-containing fuel and this hydrocarbon remains practically unburned and thus does not substantially contribute to the heat production.

In the Office Action, it is stated that the sub-stoichiometric primary zone 7 and the secondary fuel zone 8 of Leikert et al '743 are, taken together, considered to be a "flame core" such as that recited in the claims of the present application. This assertion in the Office Action is premised on the disclosure of Leikert et al '743 that the secondary zone 8 is "in the vicinity and around the primary flame zone" (Column 3, lines 34 - 35 of Leikert et al '743) and that the reducing agent supplied by the nozzles 4 of the Leikert et al '743 burner is, as allegedly shown in Figure 1 of Leikert

et al '743, "clearly distributed within the flame core formed from the flame zones 7 and 8." However, Leikert et al '743 unambiguously discloses that its reducing agent is not introduced into its primary flame zone 7 but, instead, is introduced around this primary flame zone. The Leikert et al '743 arrangement is an example of the conventional "fuel staging" approach to NO_x reduction in that the Leikert et al '743 arrangement is designed such that its reducing agent is introduced into a reduction zone that is located downstream of its burner zone, wherein a remainder portion of the fuel is added at the reduction zone - i.e., the fuel itself serves both as a fuel and a reducing agent. In fact, if the Leikert et al '743 arrangement were operated as asserted in the Office Action to distribute its reducing agent into its primary flame zone 7 instead of being operated to introduce its reducing agent into the secondary zone 8 around the primary flame zone 7, the air to fuel ratio within the secondary zone 8 would be practically the same as the air to fuel ratio within the primary flame zone 7 and there would be no demarcation between the secondary zone 8 and the primary flame zone 7. This is clearly contrary to the unambiguous disclosure of Leikert et al '743 itself that its secondary zone 8 is separate and different from its primary flame zone 7.

Moreover, the NO_x reduction mechanism of Leikert et al '743 is different from that of the present invention. According to Leikert et al '743, NO_x is produced in the primary flame zone 7 and reduced in the secondary zone 8. The NO_x reducing agent - i.e., the staged fuel - is introduced through the nozzles 4 to be burned in the secondary zone 8. In contrast, in the present invention, the reducing agent is not burned at the location in which it is introduced (the sub-stoichiometric primary zone in the form of a flame core) by reason of a lack of oxygen in this sub-stoichiometric

primary zone; instead, the reducing agent introduced in the present invention reacts directly with the nitrogen oxides within this sub-stoichiometric primary zone. This different approach of the method of the present invention can be seen in that the introduced reducing agent is in the amount of about 1% of the nitrogen-containing fuel. On the other hand, in the Leikert et al '743 arrangement, a considerably higher ratio of reducing agent to fuel must prevail, as it would otherwise not be possible to effect a reduction from n = 0.9 in the primary flame zone 7 to n = 0.55 in the secondary zone 8.

Neither of the secondary references Beer or Svendssen et al discloses supplying a reducing agent to the flame core. Likewise, U.S. Patent No. 4,739,713 to Vier et al, which is combined with Leikert et al '743 to reject claim 7 of the present application under 35 U.S.C. 103(a), does not disclose supplying a reducing agent to the flame core. The mere fact that Vier et al '713 teaches that coal dust is known to include nitrogen would not lead one of skill in the art to, in effect, turn the Leikert et al '743 arrangement on its head and introduce a reducing agent into Leikert et al '743's primary flame 7 instead of its secondary flame zone 8.

For the reasons set forth above, the Applicants respectfully submit that claims 7 – 9, 11, 12, and 16 - 19 are patentable over the cited references and request withdrawal of the respective rejections of these claims under 35 U.S.C. 103.

In light of the foregoing amendment and argument in support of patentability, the Applicants respectfully submit that this application now stands in condition for allowance. Action to this end is courteously solicited. However, should the Examiner have any further comments or suggestions, the undersigned would very much welcome a telephone call in order to discuss appropriate claim language that

will place the application into condition for allowance.

Respectfully submitted,

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